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AN EFFICIENT SYSTEM FOR HARVESTING SAND PINE BIOMASS

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Abstract.--An efficient system for harvesting Ocala sand pine (Pinus clausa var. clausa D. B. Ward) has been developed by a logging contractor. It is a highly mechanized operation using feller-bunchers, grapple skidders, and an on-site chipper. High quality wood chips are produced because the limbs and needles are left on the area and the chipper separates out much of the bark, which is captured for use as boiler fuel. The operation features integrated use of raw materials with the option to use chips as feed for the paper mill, or as fuel for the boiler during periods of high oil prices. Limbs and needles (which would produce only low-quality fuel) are instead left on site as an important nutrient source for future forest crops on these poor soils.

Additional keywords: felling, fuel biomass collection, green weight, piling, residues, windrow.

Forest biomass potentially available for use as fuel is composed largely of undesirable species, low-grade individual trees, and low-grade tree portions. Although its use has increased significantly over the last 10 years, a large portion of the fuels biomass available in the forest is still under-utilized. This material is not being utilized more because the cost of harvesting and transporting it is about equal to its value at the plant site (Stuart 1986). If the harvest costs could be reduced, it would become economical to utilize more of this material. For a variety of very good reasons, as outlined by Stuart (1986), very little research has been done on better biomass harvesting systems. Most of the advances have been in adapting conventional systems for biomass collection. The purpose of this paper is to describe such a system that has been developed for harvesting sand pine biomass.

HARVEST SYSTEM

This system is based on the use of conventional, readily available tree harvesting equipment. Although no equipment specifically designed for fuel biomass is used, the harvest system is a highly mechanized, high capital investment operation. The system is designed around a 22-inch whole-tree chipper. Wood is supplied to the chipper by four grapple skidders. Felling and piling is handled by two feller-bunchers. Chips and fuel are hauled from the chipper by ten chip-vans and two semi-tractors. Other equipment includes an extra tractor for switching vans on-site, a fuel and a repair truck. Operation of this equipment requires a crew of 10-12 people.

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The standard procedure for harvesting a sand pine stand begins with selection of a site for the chipper. Next, this site and a temporary road into it are cleared with the feller-bunchers and skidders. Then felling is begun with accumulated trees laid out in a systematic windrow pattern, with the tops all on one side and the butts on the other (Figure 1). After a number of windrows have been made, a skidder with a load of trees is driven over the tops in the windrows, which breaks most of the branches off the trees. One person with a chainsaw follows to remove any remaining branches. While the felling, windrowing, and limbing is being done, the other members of the crew are moving and setting up the chipper, which usually takes about 1 day. Once the chipper is in place the skidders began hauling tree boles to the landing for chipping into the waiting vans.

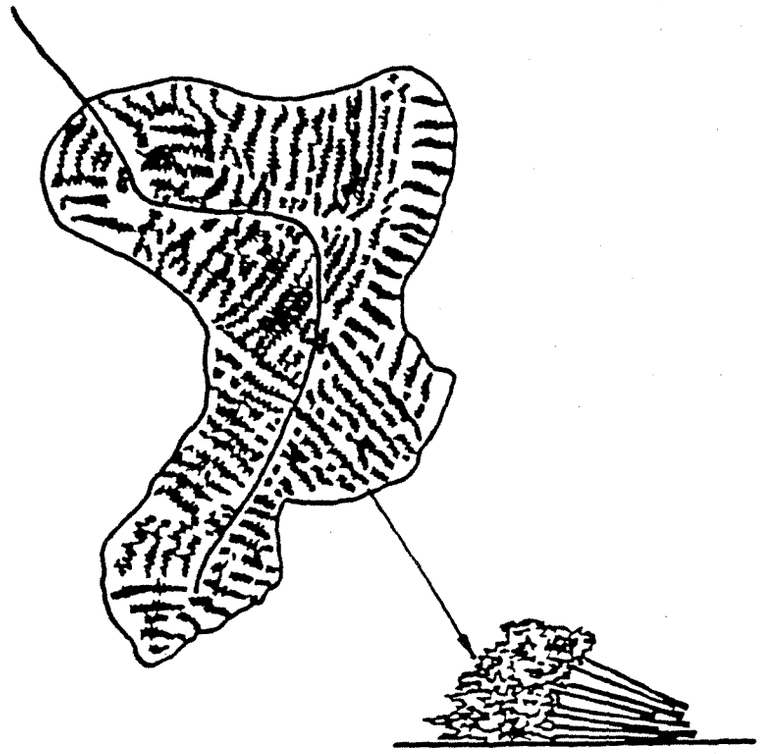

Figure 1.--Diagram of actual harvested site in Ocala National Forest, Florida, and sketch of typical windrow cross section.

On average, one load of chips is produced every 30 minutes. It takes about 9 minutes to actually chip the wood into the van. From 5 to 6 minutes are required to change vans, and an additional 15 minutes is used to skid wood to the chipper in preparation for use. In a normal day about 10 acres will be harvested producing 20 loads of chips, with a green weight of about 620 tons.

The chipper being used employs a series of screens and fans to separate the bark from the wood chips, blowing each into their respective vans for transport to the mill. This system has a depletion ratio of about 4 or 5 to 1. Thus, using sand pine boles, which are about 13 percent bark (McNab et al. 1985), would yield chips with a bark content of about 3 percent. At the mill the bark is used as biomass fuel while the wood chips are normally used as raw material for production of paper products. However, during periods of high oil prices, wood chips can and have been diverted to the boilers for use as fuel.

SUMMARY

This harvest system has a number of advantages. First, as previously noted, it uses reliable, readily available equipment designed for the woods. Because it is highly mechanized it has a high production capacity which fosters the economic harvest of even small diameter stems of this very limby species. The limbing procedure and the bark separation process result in the production of very clean chips for use as raw material for high grade papers. This harvest system allows integration of raw material uses, which is necessary for a successful operation (Roetheli 1986). Thus, the clean chips can be used as raw material for the pulp mill or as fuel for the boilers as needs and prices warrant. Finally, this harvest system has potential applicability in other areas and timber types. In mixed pine-hardwood stands for example, the hardwoods could be accumulated for chipping for fuel following the chip harvest of the pines for raw material for the mill.

Since the limbs and needles are left on the site, some might view this harvest system as rather inefficient. However, this was deliberately designed into the harvest system. Sand pine grows on nutrient-poor, sandy soils. The limbs and needles are more valuable as organic matter and as a nutrient source than as fuel. It is important to consider the on-site worth of residues when designing a harvest system and not assume that an efficient system must capture all of the available biomass.

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